Name: ________________________________ Date: ________________

Polynomial Operations SOLUTIONS (version 16)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = 8x^5 - 6x^3 + 10x^2 + 3x - 9$$

$$q(x) = -8x^5 + 6x^4 + x^3 + 3x - 5$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (8)x^5 + (0)x^4 + (-6)x^3 + (10)x^2 + (3)x^1 + (-9)x^0 \\ q(x) &= (-8)x^5 + (6)x^4 + (1)x^3 + (0)x^2 + (3)x^1 + (-5)x^0 \\ p(x) + q(x) &= (0)x^5 + (6)x^4 + (-5)x^3 + (10)x^2 + (6)x^1 + (-14)x^0 \\ p(x) + q(x) &= 6x^4 - 5x^3 + 10x^2 + 6x - 14 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 7x^2 - 5x - 4$$

$$b(x) = -8x + 2$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$7x^2$	$-5x$	-4
$-8x$	$-56x^3$	$40x^2$	$32x$
2	$14x^2$	$-10x$	-8

$$a(x) \cdot b(x) = -56x^3 + 40x^2 + 14x^2 + 32x - 10x - 8$$

Combine like terms.

$$a(x) \cdot b(x) = -56x^3 + 54x^2 + 22x - 8$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 - 11x^2 + 24x + 9 \\ g(x) &= x - 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 1 & -11 & 24 & 9 \\ 8 & & 8 & -24 & 0 \\ \hline & 1 & -3 & 0 & 9 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 - 3x + \frac{9}{x-8}$$

In other words, $h(x) = x^2 - 3x$ and the remainder is $R = 9$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 - 11x^2 + 24x + 9$. Evaluate $f(8)$.

You could do this the hard way.

$$\begin{aligned} f(8) &= (1)\cdot(8)^3 \ + \ (-11)\cdot(8)^2 \ + \ (24)\cdot(8) \ + \ (9) \\ &= (1)\cdot(512) \ + \ (-11)\cdot(64) \ + \ (24)\cdot(8) \ + \ (9) \\ &= (512) \ + \ (-704) \ + \ (192) \ + \ (9) \\ &= 9 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(8)$ equals the remainder when $f(x)$ is divided by $x - 8$. Thus, $f(8) = 9$.